Geophysical Research Abstracts
Vol. 18, EGU2016-7531, 2016
EGU General Assembly 2016

Variability of space climate and its extremes with successive solar cycles

Sandra Chapman (1), Phillip Hush (1), Elisabeth Tindale (1), Malcolm Dunlop (2,3,1), Nicholas Watkins (4,5,1)

(1) University of Warwick, Centre for Fusion, Space and Astrophysics, Physics Dept., Physics, Coventry CV4 7AL, United Kingdom (s.c.chapman@warwick.ac.uk), (2) RAL Space, Rutherford Appleton Laboratory, Didcot, United Kingdom, (3) Space Science Institute, School of Astronautics, Beihang University, Beijing, China, (4) CATS, London School of Economics and Political Science, London, United Kingdom, (5) Open University, Milton Keynes, United Kingdom

Auroral geomagnetic indices coupled with in situ solar wind monitors provide a comprehensive data set, spanning several solar cycles. Space climate can be considered as the distribution of space weather. We can then characterize these observations in terms of changing space climate by quantifying how the statistical properties of ensembles of these observed variables vary between different phases of the solar cycle. We first consider the AE index burst distribution. Bursts are constructed by thresholding the AE time series; the size of a burst is the sum of the excess in the time series for each time interval over which the threshold is exceeded. The distribution of burst sizes is two component with a crossover in behaviour at thresholds $\approx$ 1000 nT. Above this threshold, we find[1] a range over which the mean burst size is almost constant with threshold for both solar maxima and minima. The burst size distribution of the largest events has a functional form which is exponential. The relative likelihood of these large events varies from one solar maximum and minimum to the next. If the relative overall activity of a solar maximum/minimum can be estimated, these results then constrain the likelihood of extreme events of a given size for that solar maximum/minimum.

We next develop and apply a methodology to quantify how the full distribution of geomagnetic indices and upstream solar wind observables are changing between and across different solar cycles. This methodology[2] estimates how different quantiles of the distribution, or equivalently, how the return times of events of a given size, are changing.

[1] Hush, P., S. C. Chapman, M. W. Dunlop, and N. W. Watkins (2015), Robust statistical properties of the size of large burst events in AE, Geophys. Res. Lett.,42 doi:10.1002/2015GL066277

[2] Chapman, S. C., D. A. Stainforth, N. W. Watkins, (2013) On estimating long term local climate trends , Phil. Trans. Royal Soc., A,371 20120287 DOI:10.1098/rsta.2012.0287